(19) Japanese Patent Office (JP) (11) Japanese Patent Application Unexamined (Kokai) Publication
Hei 2-165936

(12) Official Gazette for Unexamined (Kokai) Patent Applications (A)

(51) Int Cl.[5] Identification code JPO file number (43) Publication date 26 June 1990
B 29 D 30/08 6949-4F
30/20 6949-4F

Examination Request None Number of Claims 1 (Total 6 pages)

(54) Title of the Invention Secondary moulding machine for radial tyre

(21) Application (Tokugan) Sho 63-322298
(22) Application Date 20 December 1988

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Description

1. Title of the Invention

Secondary moulding machine for radial tyre

2. Claims

(1) A secondary moulding machine for a radial tyre, characterised by a shaping drum for the deformation of a cylindrical primary carcass into a toroidal shape being supported in a cantilever manner; a belt moulding drum of which the diameter can be increased or reduced in order to adhere and laminate the belts and tread caps of the radial tyre endlessly on an axial extension of this shaping drum being slidably disposed in the aforementioned axial direction; a holding ring being slidably provided in the aforementioned axial direction to hold the belts and tread caps on the aforementioned belt moulding drum on the headstock side of the aforementioned shaping drum so that they can be attached and detached; and a belt servicer to provide belts and a tread servicer to provide tread caps to the aforementioned belt moulding drum being provided respectively in the aforementioned shaping drum direction.

3. Detailed Description of the Invention

(Industrial Field of Application)

This invention relates to a secondary moulding machine for a radial tyre used in motor vehicles.

(Prior Art)

Radial tyres for motor vehicles are made by a cylindrical primary carcass made on a primary moulding machine being deformed on a secondary moulding machine and by belts and tread caps being adhered to this surface. 2 types of secondary moulding machine for carrying out this kind of moulding are known, namely a transfer type and a belt ring type.

Namely, a transfer type is such that a shaping drum for the deformation of a cylindrical primary carcass into a toroidal shape is supported in a cantilever manner; a belt moulding drum to adhere and laminate the aforementioned belts and tread caps endlessly on that axial extension is slidably disposed; a belt servicer to provide belts and a tread servicer to provide tread caps are provided approximately above this belt moulding drum; a transfer ring is slidably provided between the aforementioned shaping drum and belt moulding drum to convey the laminates of the aforementioned belts and tread caps; a plurality of belts and tread caps are endlessly adhered onto the belt moulding drum; the obtained annular laminate is conveyed on the transfer ring from the belt moulding drum to the shaping drum; then, the primary carcass on the shaping drum is deformed into a toroidal shape and this surface is pressure welded onto the inner surface of the aforementioned annular laminate; thereafter, the transfer ring is enlarged, the aforementioned laminate is released, the holding ring is returned to the original position, and the inner surface of the aforementioned laminate is brought into pressure contact with the outer surface of the primary carcass by means of a stitch roller.

Also, a belt ring type is such that a belt ring is slidably disposed on both sides of a shaping

drum as above in an axial direction; after the cylindrical primary carcass has been installed on the aforementioned shaping drum, the aforementioned belt ring on both sides is adjoined and the primary carcass on the aforementioned shaping drum is surrounded at this belt ring; then, this primary carcass is deformed into a toroidal shape; the apex of this is made to stick out from the gap of the adjoining parts of the aforementioned belt ring on both sides; thereafter, a plurality of belts and tread caps straddling the belt ring on both sides are laminated in order and endlessly; these are brought into pressure contact by means of a stitch roller; the belt ring on both sides is returned to the original standby position; the aforementioned stitch roller is driven again and the inner surface of the belt and tread cap laminate is brought into pressure contact with the outer surface of the primary carcass.

(Problems to be Solved by the Invention)

However, with transfer type secondary moulding machines of the prior art, as the belts and tread caps on the tread moulding drum are laminated, this laminate is conveyed on the transfer ring to the shaping drum and heaped on the primary carcass, and, along with the conveyance on the transfer ring, displacement of the aforementioned belts and tread caps on the aforementioned primary carcass occurs, and there is the issue of a reduction of uniformity of the finished tyre.

Also, with belt ring type secondary moulding machines of the prior art, as the moulding of the belts and tread caps is carried out at the shaping drum position, there is no displacement accompanying the conveyance of the belts and tread caps, but, as a toroidal primary carcass is attached at the inner surface of the belt ring, and, on the outer surface, the belt ring is extracted with the belt in a laminated state, the belt slips due to the friction accompanying the extraction of the belt ring, the toroidal deformation of the primary carcass is reduced, the enlargement of the belt ring due to this toroidal deformation is suppressed, a long time is required for the stitching work after the belt ring extraction, and there is the issue of reduced productivity in comparison to the transfer type.

The purpose of this invention is to provide a new type of secondary moulding machine that has the advantages of the belt ring type secondary moulding machine of the prior art but that has eliminated the disadvantages, that conveys the belt and tread annular laminate, that does not require the extraction of the belt ring, and that has the same large degree of toroidal deformation of the primary carcass as the transfer type of the prior art so that stitching time is reduced.

(Means for Resolving the Problems)

The secondary moulding machine for a radial tyre of this invention is, as shown in Figure 1, characterised by a shaping drum 3 for the deformation of a cylindrical primary carcass A into a toroidal shape being supported in a cantilever manner; a belt moulding drum 9 of which the diameter can be increased or reduced in order to adhere and laminate the belts and tread caps of the radial tyre endlessly on an axial extension of this shaping drum 3 being slidably disposed in the aforementioned axial direction; a holding ring 11 being slidably provided in the aforementioned axial direction to hold the belts and tread caps on the aforementioned belt moulding drum 9 on the headstock 1 side of the aforementioned shaping drum 3 so that they can be attached and detached; and a belt servicer 12 to provide belts and a tread servicer 13 to provide tread caps to the aforementioned belt moulding drum 9 being provided respectively in the aforementioned shaping drum 3 direction.

The shaping drum 3 used in this invention is formed in the same way as that used in the transfer type secondary moulding machine of the prior art, and is installed in a cantilever manner at the front end part of the main shaft 2 protruding horizontally from the headstock 1; the primary carcass A is installed so as to straddle the left and right flanges 3a, 3b; as the space for the movement towards the central side of the aforementioned left and right flanges 3a, 3b is restricted, pressurised air is fed between the flanges 3a, 3b and the aforementioned primary carcass A is deformed into a toroidal shape. Also, the belt moulding drum 9 is, other than being slidable in the axial direction of the aforementioned shaping drum 3, constituted in the same way as the prior art, with the drum being constituted so that a plurality of segments can slide in the radial direction, and the drum diameter is deformed due to this segment sliding. Furthermore, the holding ring 11 has substantially the same constitution as the transfer ring used in the transfer type machine of the prior art, but,

whereas the transfer ring of the prior art slides between the shaping drum 3 and the belt moulding drum 9, the holding ring differs in that it slides between the shaping drum 3 and the headstock 1, namely on the opposite side. Also, the belt servicer 12 and the tread servicer 13 are, in this invention, disposed facing the shaping drum 3, whereas, in the transfer type of the prior art, they are disposed at the position of the belt moulding drum 9.

(Operation)

After the primary carcass A has been attached to the shaping drum 3, the belt moulding drum 9 moves to the position of the shaping drum 3, and, on this belt moulding drum 3[1], belts are supplied from the belt servicer 12 and tread caps are supplied from the tread servicer 13 and are endlessly adhered. Next, the holding ring 11 moves to the position of the shaping drum 1[2], the belt and tread cap annular laminate is held from outside at this holding ring 11, and, thereafter, the diameter of the belt moulding drum 9 is reduced, and the belt moulding drum 9 is separated from the aforementioned annular laminate. Then, after this separation, the primary carcass A on the shaping drum 3 is deformed into a toroidal shape, that outer surface is pressure welded with the inner surface of the annular laminate, the holding of the holding ring 11 is thereafter released, the holding ring 11 is returned to its original standby position, the stitch roller (not shown in the diagrams) then pressure welds to adhere the aforementioned annular laminate to the toroidal primary carcass, and secondary moulding is completed.

(Embodiments)

As shown in Figure 1 and Figure 2, a shaping drum 3 is constituted on which are installed 2 flanges 3a, 3b at the front end part of the main shaft 2 that is supported in a cantilever manner at the headstock 1 used by the shaping drum. 2 rails 5 are disposed parallel to the aforementioned main shaft 2 by means of a lower frame 4 below this shaping drum 3, a drum base 6 is placed so as to freely slide on these rails 5, and this drum base 6 moves between the illustrated standby position and the shaping drum 3 by a conveying means such as a rotating screw shaft (not illustrated). The belt moulding drum 9 is installed on the horizontal shaft 8 and driven by a motor 7 supported in a cantilever fashion on this drum base 6. A ring base 10 is installed so as to slide freely on the rail 5 of the headstock 1 side, is constituted so as to move between the connected illustrated standby position and the shaping drum 3 by a conveying means such as a driving chain (not illustrated), and the holding ring 11 is disposed on this ring base 10. The belt servicer 12 and tread servicer 13 are disposed respectively approximately above the shaping drum 3.

One example of the aforementioned belt moulding drum 9 is shown in Figure 3. Namely, a plurality of arms 21 are fixed radially by means of a boss 21a at the free end of the aforementioned horizontal shaft 8, a guide rail 22 (refer to Figure 4) is fixed on the shaping drum 3 side surface of this arm 21, and, on the opposite side, an annular protuberance 21b is formed concentrically with the aforementioned boss 21a. On the aforementioned guide rail 22, a slide plate 23 is installed so as to slide freely by means of a slider 24. This slide plate 23 has a first arm 23a extending on the shaping drum 3 side and a second arm 23b extending on the opposite side, an angular insertion hole 23c of the aforementioned radial arm 21 and guide rail 22 on this second arm 23b is formed, a fluid cylinder 25 is fixed in the radial direction at the front end part of the second arm 23b, and the side end part of the horizontal shaft 8 of that piston rod 25a is connected to the aforementioned annular protuberance 21b. The segments 9a of the belt moulding drum 9 are fixed at the end part of the first arm 23a, and, when each slide plate 23 is positioned at the inner end of the radial direction stroke, all of the segments 9a connect mutually to form a cylinder. Furthermore, the diameter of the belt moulding drum 9 at the time of enlargement is adjusted by the thickness of the stopper 26 fixed on the outward facing protruding end of the piston stopper 25a of the fluid cylinder 25.

The holding ring 11 is such that, as shown in Figure 5 and Figure 6, a plurality of fluid cylinders 31 are arranged with equal spacing on the periphery, slide rods 32, 32 positioned on both sides of the piston rods 31a and fluid

[1] Translator belives this should be "belt moulding drum 9" not "belt moulding drum 3" as elsewhere in the text, there is reference to a "belt moulding drum 9".

[2] Translator belives this should be "shaping drum 3" not "shaping drum 1" as elsewhere in the text, there is reference to a "shaping drum 3".

cylinders 31 pierce the holding ring 11 respectively in a slidable manner, and each protruding end of the aforementioned piston rods 31a and slide rods 32, 32 is fixed on a holding segment 33. A stopper 34 is fitted to suppress the amount of slide of the holding segments 33 at the outwardly protruding ends of the aforementioned piston rods 31a.

According to the aforementioned constitution, as shown in Figure 2, after the cylindrical primary carcass A has been installed on the shaping drum 3, the belt moulding drum 9 in the enlarged state of the standby position is moved to the position of the shaping drum 3. Then, as shown in Figure 7, belt B from the belt servicer 12 and tread cap C from the tread servicer 13 are supplied, are adhered endlessly on the belt moulding drum 9 and are laminated.

Next, the holding ring 11 of the standby position of the headstock 1 side is moved to the position of the shaping drum 3 and, as shown in Figure 8, the holding segments 33 in an enlarged state surround the periphery of tread caps C. Thereafter, the piston rods 31a of the fluid cylinders 31 of the holding ring 11 are pushed out at the central side; the holding segments 33, as shown in Figure 9, connect with the periphery of the tread cap C and hold the annular laminate of the tread cap C and belt B; after this holding, the piston rod 25a of the fluid cylinder 25 of the belt moulding drum 9 is drawn in and the belt moulding drum 9 is reduced in diameter; the belt moulding drum 9 is separated from the inner surface of the belt B and the belt moulding drum 9 is returned to its original standby position.

After the separation of the aforementioned belt moulding drum 9, by the feeding of pressurised air into the space surrounding the 2 flanges 3a, 3b of the shaping drum 3 and the primary carcass A and the restriction of the spacing of the 2 flanges 3a, 3b (refer to Figure 10), the primary carcass A is deformed into a toroidal shape and the peripheral surface of the toroidal primary carcass A is pressure welded to the inner surface of the belt B. Then, the holding segments 33 that draw in the piston rods 31a of the fluid cylinders 31 of the holding ring 11 are enlarged and, after the holding ring 11 has returned to its original standby position, as the stitch roller (not illustrated) pressure welds the tread cap C, the main shaft 2 rotates, the toroidal primary carcass A, belt B and tread cap C are adhered together and a green tyre is obtained as shown in Figure 11.

In the aforementioned embodiment, although it is possible that, instead of fluid cylinders 25 of the belt moulding drum 9 being disposed, a cylindrical holding member is disposed on the inner side of the belt moulding drum 9, bladders are installed on the segment 9a on the circumference of this cylindrical member and the segment 9a is caused to slide in a radial direction by the inflation and deflation of these bladders, as, in the embodiment, the inner side space of the segment 9a becomes enlarged, it is easy for the sliding stroke volume of the segment 9a to become great and easy for the adjustment of the stroke volume to be carried out according to changes in the thickness of the stopper 26. It is also possible for the fluid cylinders 31 of the outer side of the holding ring 11 to be replaced by the disposition of bladders on the inner side.

(Effects of the Invention)

By, without moving the belt moulding drum to the position of the shaping drum, adhering the belts and tread caps and laminating in this position, then moving the obtained laminate, and instead moving the holding ring, moving the aforementioned laminate from the belt moulding drum to the holding ring, and deforming the primary carcass on the shaping drum at the inner side of the laminate into a toroidal shape and pressure welding this periphery onto the inner side of the aforementioned laminate, as the belts and tread caps are not moved in the axial direction of the shaping drum, the displacement accompanying the movement seen in the transfer type of the prior art does not occur, and the uniformity of the finished tyre is improved. Moreover, as with the transfer type of the prior art, as the belts and tread caps are formed on the belt moulding drum, it is possible for the toroidal deformation of the primary carcass to be to the same degree as that of the transfer type, stitching is reduced in comparison to the belt ring type of the prior art and it is possible for productivity to be increased. Namely, it is possible to keep the advantages and discard the disadvantages of the transfer type and belt ring type of the prior art.

4. Brief Description of the Drawings

Figure 1 is a plan view of the embodiment of this invention, Figure 2 is a front view of the essential parts of Figure 1, Figure 3 is a partially fractured front view of the essential parts of the belt moulding drum, Figure 4 is a sectional view of the IV - IV line of Figure 3, Figure 5 is a side view of the holding ring, Figure 6 is a sectional view of the VI - VI line of Figure 5, and Figure 7 to Figure 11 are front views of the shaping drum part to explain the operational state.

A: primary carcass, B: belt, C: tread cap, 1: headstock, 2: main shaft, 3: shaping drum, 5: rail, 6: drum base, 9: belt moulding drum, 10: ring base, 11: holding ring.

Patent applicant: Toyo Tyre& Rubber Co., Ltd

Agent: Patent Attorney YOSHIDA Ryouji

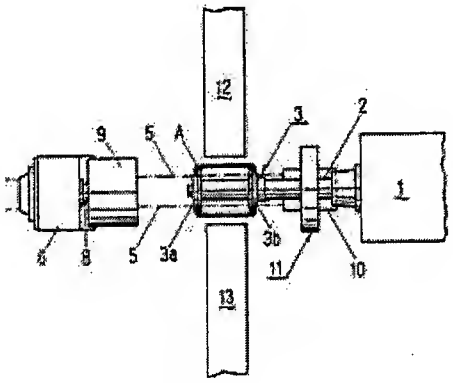

Figure 1

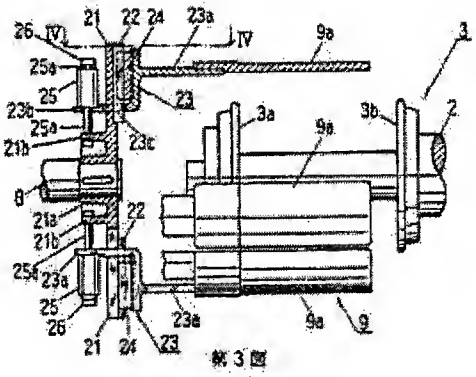

Figure 3

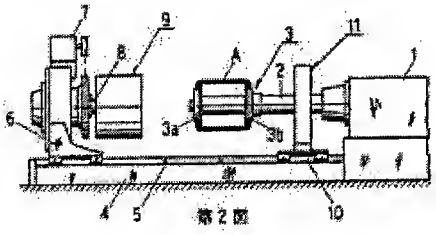

Figure 2

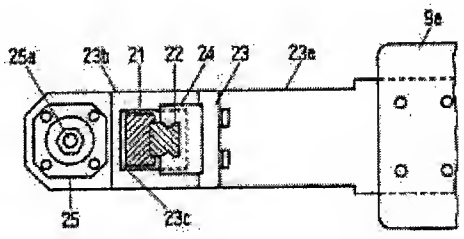

Figure 4

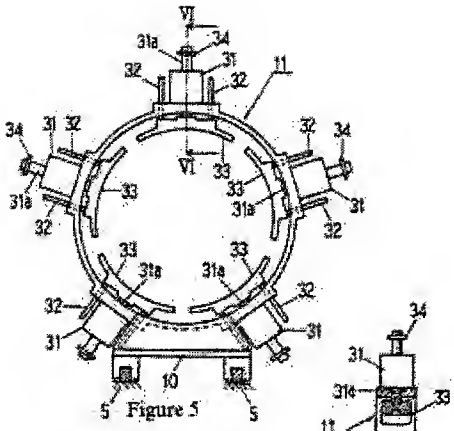

Figure 5

Figure 6

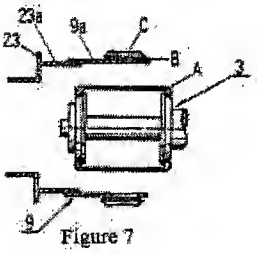

Figure 7

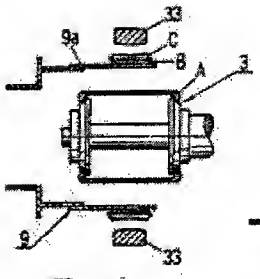

Figure 8

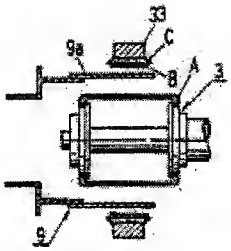

Figure 9

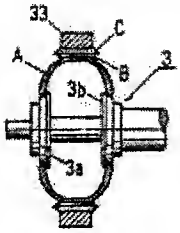

Figure 10

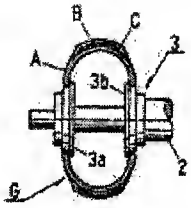

Figure 11